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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,103	03/31/2004	Keith E. Fogel	YOR920030190US1	6557

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EXAMINER
ANDUJAR, LEONARDO

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 10/31/2006

David Aker
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Hartsdale, NY 10530

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/815,103	FOGEL ET AL.	
	Examiner	Art Unit	
	Leonardo Andújar	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 August 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-46* is/are pending in the application.

4a) Of the above claim(s) *1-14,28 and 37-46* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15-27,29-32,35 and 36* is/are rejected.

7)☒ Claim(s) *33 and 34* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of method of forming a three layer BLM (claims 15-27 and 29-36) in the replies filed on 05/01/2006 and 08/14/2006 is acknowledged.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 15-17, 19, 21, 23, 25 and 27are rejected under 35 U.S.C. 102(e) as being anticipated by Jan et al. (US 7,081,404).

4. Regarding claim 15, Jan (e.g. figs. 1-4 or 5-8) shows method for forming an interconnection structure suitable for flip-chip attachment of microelectronic device chips to packages, comprising: forming a ball limiting composition (27 or 127, 29 or 129, 32 or 132) on a substrate; forming a resist pattern (31 or 131) on the ball limiting composition; etching the ball limiting composition by using the resist as an etch mask; removing the resist from remaining ball limiting composition; and depositing solder on the ball (35 or 135) limiting composition (col. 7/lls. 64-67 & col. 8/lls. 1-11).

5. Regarding claim 16, Jan teaches that the solder is substantially lead free such a gold bump (col. 2/lls. 40-42).

6. Regarding claim 17, Jan teaches ball limiting composition is formed by: depositing an adhesion (27 or 127) layer on said substrate; depositing a reaction barrier layer (29 or 129) on said adhesion layer; and depositing a solder wettable (32 or 132) layer on said barrier layer.

7. Regarding claim 19, Jan teaches adhesion layer is deposited by sputtering, plating or evaporating (col. 4/lls. 64-67).

8. Regarding claim 21, Jan teaches that the reaction barrier is formed by sputtering (col. 1/lls. 45-48).

9. Regarding claims 23 and 27, Jan teaches that the solder wettable layer is deposited by electroplating (col. 5/lls. 24-37).

10. Regarding claim 25, Jan teaches the step of depositing a layer comprising Au or Sn on the solder wettable layer (e.g. capping layer, col. 1/lls. 29-41).

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over anticipated by Jan et al. (US 7,081,404) in view of Lee et al. US (6,756,671).

13. Regarding claim 18, Jan teaches most aspects of the instant invention including lead free solder bump (e.g. gold) and reaction barrier (BML) made of Cr-Cu (col. 1/lls. 54-62 7 col. 2/lls. 40-42) but does not disclose that the reaction barrier (i.e. first layer of the BML) can be made of a material selected for the group consisting of Ti, TiN, Ta, TaN, Zr, ZnN, V and Ni. However, Lee teaches that Cr--Cu, Ti--Pd, Ti--W, or Ti—Pt are suitable BML for gold bump (col. 2/lls.46-62). It would have been obvious to one having ordinary skill in the art at the time the invention was made to make the reaction barrier (i.e. first layer of the BML) of Jan consisting of Ti as suggested by Lee, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended (e.g. gold bump) use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

14. Claims 20, 22, 24 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over anticipated by Jan et al. (US 7,081,404).

15. Regarding claims 20, 22, 24 and 26, Jan fails to specify the thickness of the adhesion layer, reaction layer, solder wettable layer, and Au or Sn layer. However, differences in thickness will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such thickness and/or concentration are critical. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the workable ranges by routine experimentation". *In re Aller*, 220 F.2d 454,456,105 USPQ 233, 235 (CCPA 1955).

Since the applicant has not established the criticality (see next paragraph) of the adhesion layer, reaction layer and solder wettable layer thicknesses, it would have been obvious to one of ordinary skill in the art to use these values in the device of Jan.

CRITICALITY

16. The specification contains no disclosure of either the critical nature of the claimed mole ratio or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

17. Claims 30 and 35 are rejected under 35 U.S.C. 102(e) as being anticipated by Jan et al. (US 7,081,404) in view of Applicant admitted prior art.

18. Regarding claim 30, Jan (e.g. figs. 1-4 or 5-8) shows a method for forming an interconnection structure suitable for flip chip attachment of microelectronic device chips to chip carriers, comprising: depositing an adhesion layer (27 or 127) on a wafer 121, depositing a solder reaction barrier layer (29 or 129) on the adhesion layer; depositing a wettable layer (32 or 132) on the reaction barrier layer; depositing a free solder 135 on the solder wettable layer. Jan does not disclose the step of reflowing the solder so that the solder wettable layer diffuses into the lead free solder. However, Applicant admitted prior art teaches that it is known in the art to include the step of flowing the solder so that the reaction barrier diffuses into the solder to provide good mechanical integrity for the reliable solder joint (see page 6/lls. 1-8). It would have been obvious to one having ordinary skill in the art at the time the invention was made to include the step of reflowing the solder disclosed so that the solder wettable layer (i.e. top layer) diffuses

into the lead free solder to provide good mechanical integrity for the reliable solder joint as taught by applicant admitted prior art.

19. Regarding claim 35, it is implicit from the teaching of the Jan in view of Applicant admitted prior art that a binary solder would be formed during the reflowing due to the diffusion of metal atoms from layer 32 or 132 to the solder. Therefore, the solder composition is increased by at least one element by the diffusion.

20. Claims 31-32 rejected under 35 U.S.C. 102(e) as being anticipated by Jan et al. (US 7,081,404) in view of Applicant admitted prior art further in view of Barnak et al. (US 7,064,446).

21. Regarding claim 31, Jan in view of applicant admitted prior art teaches that the wettable material diffuses into the solder during the reflowing step but does not teach that copper can be used as solder wettable layer as alternative to nickel (i.e. top layer). Nevertheless, Barnak teaches that copper can be used as a solder wettable layer as alternative to nickel (col. 4/lls. 1-10). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use copper instead of nickel in the invention disclosed by Jan in view of Applicant admitted prior art as suggested by Barnak, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

22. Regarding claims 32 Jan in view of applicant admitted prior art teaches that the pure tin is a suitable solder bump material Nevertheless, Barnak teaches that pure tin is suitable bump material (col. 1/lls. 51-61). It would have been obvious to one having

ordinary skill in the art at the time the invention was made to make the solder bump disclosed by Jan in view of Applicant admitted prior art of pure tin as suggested by Barnak, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

23. Claim 36 is rejected under 35 U.S.C. 102(e) as being anticipated by Jan et al. (US 7,081,404) in view of Applicant admitted prior art further in view of Liang (US 5,532,612).

24. Regarding claim 36, Jan in view of Applicant admitted prior art shows most aspects of the instant invention except for the step of annealing at 150-250 degrees for 30 to 60 minutes. However, Liang teaches the step of annealing a gold bump for 30 minutes (col. 7/lls. 49-54). It would have been obvious to one having ordinary skill in the art at the time the invention was made to anneal the bump for at least 30 minutes as suggested by Liang to increase the strength and the reliability of the bump. Although Jan in view of Applicant admitted prior art further in view of Liang does not teach the specific temperature range, differences in temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such temperature ranges are critical. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the workable ranges by routine experimentation". *In re Aller*, 220 F.2d 454,456,105 USPQ 233, 235 (CCPA 1955).

25. Claim 29 is rejected under 35 U.S.C. 102(e) as being anticipated by Jan et al. (US 7,081,404) in view of Liang (US 5,532,612).

26. Regarding claim 29, Jan shows most aspects of the instant invention except for the step of annealing at 150-250 degrees for 30 to 60 minutes. However, Liang teaches the step of annealing a gold bump for 30 minutes (col. 7/lls. 49-54). It would have been obvious to one having ordinary skill in the art at the time the invention was made to anneal the bump for at least 30 minutes as suggested by Liang to increase the strength and the reliability of the bump. Although Jan in view of Liang does not teach the specific temperature range, differences in temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such temperature ranges are critical. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the workable ranges by routine experimentation". *In re Aller*, 220 F.2d 454,456,105 USPQ 233, 235 (CCPA 1955).

Allowable Subject Matter

27. Claims 33-34 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

28. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leonardo Andújar whose telephone number is 571-272-1912. The examiner can normally be reached on Mon through Thu from 9:00 AM to 7:30 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J. Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Leonardo Andujar
Primary Examiner
Art Unit 2826

10/28/2006